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Subjective Effects of *Salvia Divinorum*: LSD- or Marijuana-like?

Dawn N. Albertson, Ph.D.* & Laura E. Grubbs, B.S.**

Abstract—*Salvia divinorum* is a naturally occurring psychedelic considered to be one of the most potent hallucinogens found to date. The few behavioral studies conducted conclude that *Salvia*'s effects may be similar to traditional psychedelics, which is noteworthy because *Salvia* acts via a unique molecular mechanism as a kappa opioid receptor agonist. One hundred and ninety-three participants, including 34 *Salvia* users, were asked to fill out a series of questionnaires related to general drug use, personality characteristics, demographics and their experiences with *Salvia*. *Salvia* users were found to differ from nonusers on personality characteristics and reported consuming significantly more alcohol than nonusers. In addition, although *Salvia* users rated their hallucinogenic experiences as similar to those seen in previously published reports, the majority likened their experiences as most similar to marijuana instead of more traditional psychedelics. Low scores on the ARCI LSD subscale confirmed this finding and call into question the reigning theory of LSD-like subjective effects elicited by *Salvia*.

Keywords—personality measures, *Salvia divinorum*, subjective effects

Salvia divinorum (*Salvia*) is a member of the mint family known for its hallucinogenic properties. Originally discovered in the Oaxaca region of Mexico, it was used by Mazatec shaman for religious and medicinal purposes (Valdes, Díaz & Paul 1983; Wasson 1962). Brought to the United States by ethnobotanists, it was cultivated in relative obscurity until the late twentieth century (Siebert 1994). Currently, *Salvia* is legal in most states and countries although there is a growing movement to ban the substance (DEA 2008). In a study of online dietary supplement sites, Dennehy and colleagues (2005) found *Salvia* being widely advertised as a legal alternative to illicit substances. Direct

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evidence of its widespread use and popularity among college age students is evident in a recent study conducted at a southern California university, which found that 4.4% of the surveyed population had used *Salvia* within the last 12 months (Lange et al. 2008).

As a recreational drug, *Salvia* is commonly referred to as diviners sage, Maria Pastora, magic mint or PurpleSticky™. The active ingredient, Salvinorin A has been identified as the most potent natural hallucinogen found to date (Siebert 1994; Valdes 1994). In addition, *Salvia* is of particular interest because it utilizes a unique mechanism of action as a selective kappa opioid receptor agonist (Butelman, Harris & Kreek 2004; Chavkin et al. 2004; Roth et al. 2002). This is in direct contrast to more traditional hallucinogens like LSD and psilocybin mushrooms, which act via serotonin receptors.

The relatively few studies addressing the subjective effects of *Salvia* in humans reached disparate conclusions. A

TABLE 1
Number of Users and Current Frequency of Substance Use within an Average Week

	<i>Salvia</i> Users (34 total)		Nonusers (159 total)	
	N	M \pm SD (Reporting N)	N	M \pm SD (Reporting N)
Alcohol	34	7.6 \pm 10.9* (28)	129	2.8 \pm 3.5 (126)
Cigarettes	31	38.9 \pm 38.7 (20)	57	19.8 \pm 34.6 (47)
Cannabis	34	5.0 \pm 6.3 (25)	33	3.4 \pm 4.5(26)
Ecstasy	12	1.0 \pm 0 (1)	5	0.4 \pm 0.6 (2)
Cocaine	20	2.3 \pm 1.9 (5)	11	2.7 \pm 3.3 (7)
Amphetamine	10	4.0 \pm 0 (1)	7	5.9 \pm 7.7 (5)
Opiates	11	- (0)	6	0.7 \pm 0.5 (4)
Rx	15	2.1 \pm 2.8 (5)	14	4.1 \pm 4.3 (11)
Mushrooms	23	0.6 \pm 0.6 (2)	12	0.7 \pm 0.5 (8)
LSD	9	1.0 \pm 0 (2)	3	1.3 \pm 0.6 (3)
PCP	1	- (0)	1	1 \pm 0 (1)
Peyote	2	- (0)	0	- (0)

Note: N = Number of participants reporting previous experience with the drug; Reporting N = Number of participants reporting a frequency of use per week from which the mean and standard deviation were derived.

*Significantly different from nonusers ($p \leq 0.05$)

qualitative study of 10 *Salvia* users conducted by Dalgarno (2007) concluded that *Salvia*'s effects were most similar to the dissociative anesthetic ketamine. In contrast, a quantitative study of 32 Spanish *Salvia* users concluded that *Salvia*'s effects were most similar to LSD (Gonzalez et al. 2006).

The purpose of the present study was to attempt to replicate and extend the quantitative study conducted on *Salvia* users by Gonzalez and colleagues (2006). In addition to clarifying some of the subjective effects of the drug in an American population, the current study also assessed a variety of behavior and personality characteristics of users in comparison to nonusers.

METHODS

One hundred and ninety-three college-aged participants were recruited from a medium-sized Midwestern University where the research was approved by the institution's ethics board. Participants were recruited via word of mouth and the university's Research Participation System throughout the 2007-2008 academic year, and were informed that their participation was anonymous.

All participants were asked to indicate if they had previous experience with a list of drugs and the average number of times per week they used each substance. *Salvia* users were asked to fill out two surveys that required retrospective recall and analysis of users' most recent *Salvia* experience: (1) the Hallucinogen Rating Scale (HRS), which measures psychedelic-induced subjective effects, includes 71-items that are allotted into six scales: somesthesia, affect, volition, cognition, perception and intensity (Strassman et al. 1994); and (2) the short form of the Addiction Research Center Inventory (ARCI) LSD subscale, developed to assess LSD-like somatic-dysphoric effects (Martin et al. 1971).

All participants were asked to provide basic, non-identifying demographics and a short form of the Big Five Personality Inventory (BFI-54) to assess their levels of extraversion, agreeableness, conscientiousness, emotional stability and openness (John, Donahue & Kentle 1991). Most statistics were descriptive in nature but when comparing groups, a Student's t-test was used with a cutoff level of $p \leq 0.05$.

RESULTS

Demographic Characteristics

Of the 193 participants, 34 were self-identified *Salvia* users (57.6% male, 42.4% female). The other 159 nonusers included 37 males (23.3%) and 122 females (76.7%). Twenty-eight *Salvia* users reported their age, with the average being 21 years ($SD = 1.79$). The average age of 149 responding nonusers was also 21 years ($SD = 4.80$).

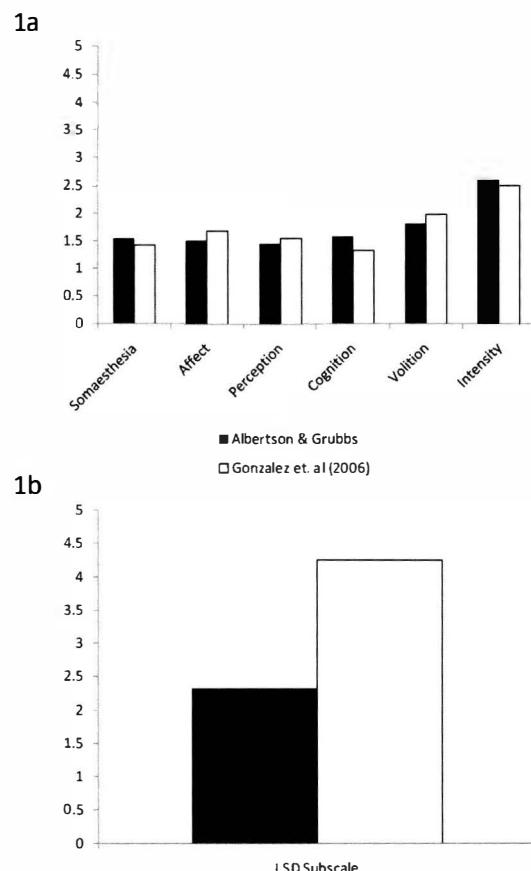
Drug Use History (Other Than *Salvia*)

There was a significant difference in alcohol consumption between *Salvia* users and nonusers ($t(32) = 2.24, p = 0.03$) as well as a trend for cigarettes ($t(80) = 1.73, p = 0.09, n.s.$) with *Salvia* users consuming more of both per week. There was no significant difference between groups for weekly marijuana use ($t(49) = 1.20, p = (n.s.)$), although it is worth noting that every *Salvia* user reported experience with marijuana. Table 1 contains the descriptive data for each surveyed substance.

History and Pattern of *Salvia* Use

The majority of the self-identified *Salvia* users (67.6%) had their first experience a year prior to the collection of data, with 52.9% having used it within the last year. Of the 18

FIGURE 1
Comparison of Hallucinogenic Effects between the Current and Gonzalez et al. (2006) Studies



Black bars represent averages from the current study; white bars represent data reported from Gonzalez et al. (2006).
 1a) Average scores on each of the six HRS subscales. Ib) ARCI LSD subscale means of each group.

who reported, 83.3% disclosed using *Salvia* every other month, 11.1% used once a month and 5.6% used once a week.

Over half (58.8%) reported getting their *Salvia* from a "head shop," while 35.3% got it from a friend and 5.9% purchased it from the Internet. Twenty-four participants reported using *Salvia* in the form of extract (10x-60x), whereas 10 used leaves which were believed by the subjects to be pure. Over half (60.6%) of the *Salvia* users reported smoking only extract, while 21.2% smoked only leaves and 18.2% smoked both leaves and extract. All 33 participants who responded used a bong (55%) or pipe (45%) to smoke *Salvia*. Although no one reported mixing *Salvia* with tobacco, nine participants mixed *Salvia* with marijuana.

The experience elicited by *Salvia* was rated on average as "intense" to "extremely intense" by the majority of participants (73.5%). Although specifically asked, no one used *Salvia* for religious or medicinal purposes. One participant desired to continue to use *Salvia* on a regular basis (3%), and 44.1% stated that they would like to continue to

use *Salvia* on an irregular basis. Twenty-four participants reported their *Salvia* experience as similar to another drug; those failing to report often indicated that *Salvia* was too unique to be comparable. Of the responders, 43.8% found their *Salvia* experience to be most similar to marijuana, and 21.9% of participants reported the effects of *Salvia* as similar to psychedelic mushrooms. Only 9.4% reported their experiences as most similar to LSD. Each person reporting a direct drug comparison had disclosed previous experiences with said drug. Interestingly, of the nine *Salvia* users who had tried LSD, only one said their experience was LSD-like, while three reported marijuana-like effects. In addition, of the 23 *Salvia* users who had experience with mushrooms, only six reported their experience as most like mushrooms while seven reported it as most similar to marijuana.

Hallucinogen Rating Scale (HRS) and ARCI LSD Subscales

Figures 1a and b present the HRS and ARCI scores, respectively, obtained from the current study in comparison

to that of Gonzalez and colleagues (2006). Both studies show similar scores on each of the six HRS subscales, indicating comparable general hallucinogenic experiences; however, the groups' scores on the ARCI LSD scale are markedly different, indicating a relative lack of LSD-like effects in the current participants.

Big Five Personality Inventory

There were no significant differences between *Salvia* users and nonusers on extraversion ($t(40) = -.996, p = .325, n.s.$) or emotional stability ($t(189) = -.020, p = .984, n.s.$). However, *Salvia* users ($M = 34.34, SD = 5.74$) reported being less agreeable than nonusers ($M = 36.33, SD = 4.84$), ($t(189) = -2.05, p = .041$). They ($M = 31.03, SD = 4.59$) also appear to be less conscientious than nonusers ($M = 34.35, SD = 4.58$), ($t(189) = -3.74, p < .001$). In addition, *Salvia* users ($M = 66.88, SD = 10.75$) were found to be more open to new experiences than nonusers ($M = 62.41, SD = 8.83$), ($t(189) = 2.51, p = .013$).

DISCUSSION

The current study represents the largest sample of *Salvia* users gathered to date. In addition we are able to report the first personality measures of a *Salvia*-using sample, finding significant differences between users and their nonusing counterparts. We report, for the first time, that *Salvia* users consume significantly more alcohol per week than nonusers (Table 1).

Overall, the study participants show similar *Salvia* acquisition and use patterns as those seen in the Spanish study conducted by Gonzalez and colleagues (2006), including scores on the State Trait Anxiety Inventory (data not shown). The most noteworthy exception was in their attributions of the *Salvia* experience. Although data from the HRS indicate that participants from both studies experienced *Salvia* effects at a level nearly indistinguishable from one another (Figure 1a), there appears to be a discrepancy in the specifics of the experience. In the current study, the largest group of participants reported their experience as marijuana-like, whereas 55% of Gonzalez and colleagues' participants reported the experience to be most similar to the traditional psychedelic psilocybin mushrooms. Scores on the ARCI LSD subscale echo this contrast with the Gonzalez participants, showing a clear LSD-like effect that is not seen in the current report (Figure 1b).

It is worth noting that the number of participants in the present study who had previous experience with traditional psychedelics was different than the Gonzalez participants (2006), with the current participants reporting less LSD and psilocybin mushroom use. However, of the current subjects

who had proper reference for the experience, most failed to report their *Salvia* experience as similar to traditional psychedelics, providing further support for the validity of the low LSD subscale scores seen for the group.

It was considered that perhaps the likening of *Salvia* to marijuana could be an artifact from mixing the two during administration. However, of those equating their experience to marijuana, only 21.4% had mixed *Salvia* with marijuana. Similarly, 27.8% of the participants who likened their experience to something other than marijuana had administered *Salvia* and marijuana simultaneously. The comparable percentages across groups lead to our conclusion that these data are unlikely a false interpretation created by mixing the two drugs.

Of course, with the respective analysis required in both studies, there is always the possibility that some subjects were misinformed as to the substance they were administering possibly leading to erroneous data and reflection. However, assuming subjects correctly reported *Salvia* use, we know that *Salvia* has an inverted u-shaped dosing curve with lower doses being rewarding and higher doses becoming aversive (Braida et al. 2008). As the ARCI LSD subscale measures dysphoric drug effects, it is possible that participants from the current study simply took less drug and therefore had less dysphoria leading to low LSD subscale scores. However, our participants report the use of extract up to 60x potency while the Gonzalez study (2006) participants had a maximum report of 20x extract indicating that, in at least those who use extract, their drug dosage can assumed to be equivalent or greater. These same investigators found evidence to indicate at least an indirect interaction between kappa-opioid and endocannabinoid systems with *Salvia* administration (Braida et al. 2008). Therefore, although the majority of past studies report the behavioral effects of *Salvia* as most similar to traditional psychedelics, there is literature to support the notion of a more marijuana-like effect, although future research will be necessary to illuminate the meaning of these findings.

In conclusion, although we were not attempting to tackle the full spectrum of *Salvia*'s effects and subjective experiences, significant similarities and differences in subjective *Salvia* experience were found between the current and previously published studies. Critical to teasing apart these apparently disparate effects will be direct control over the dosages and content of drug administered, as well as gathering detailed data on previous hallucinogen use. Finally, continuing efforts to clarify the neurobiological underpinnings of *Salvia*'s unique action in humans is of the utmost importance as this drug continues to gain momentum and popularity.

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